PESTICIDES IN ONTARIO MUNICIPAL DRINKING WATER FROM SURFACE SOURCES 1987

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Report prepared by:
J.E. Patrick
Drinking Water Technology Specialist
Drinking Water Section
Water Resources Branch

SEPTEMBER 1990

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EXECUTIVE SUMMARY

A monitoring program, specifically for the detection of pesticides in surface waters, was not conducted by the Ministry of the Environment (MOE) in 1987. However, pesticide information from other programs was available and is reported herein.

This report contains a composite of pesticide data from two sources: the MOE, Drinking Water Surveillance Program (DWSP), and the Ontario Ministry of Agriculture and Food (OMAF).

The data was gathered as a follow-up to the 1985 and 1986 MOE pesticide studies. These earlier studies examined the extent to which surface waters and groundwaters, used for municipal and private drinking water, were contaminated by the application of pesticides to agricultural land.

The report presents the results of pesticide analyses originating from two independent monitoring programs, carried out at six municipal surface waterworks in 1987. The results were selected according to the location of the water supply, that is, the water supplies most likely to contain pesticide contamination, based on past results.

Thirteen pesticide compounds: alachlor, ametryne, atratone, atrazine, d-ethyl atrazine, cyanazine, metolachlor, prometone, prometryne, propazine, metribuzin (Sencor), simazine, and d-ethyl simazine, were analyzed. Guidelines have been set for all but one compound (atratone) by Health and Welfare Canada (H&WC), or the United States Environmental Protection Agency (EPA).

The results indicate that atrazine, d-ethyl atrazine, cyanazine, and metolalchlor were detected in the raw and treated water.

Atrazine occurred most frequently, and was found in 63 percent of the samples. The concentrations ranged from 0.10 to 62 ug/L in the raw water and from 0.12 to 210 ug/L in the treated water. D-ethyl atrazine, where analyzed, was found at low levels in 68 percent of the samples that contained atrazine. The maximum concentration of d-ethyl atrazine, detected in the treated water, was 1.6 ug/L. The H&WC Interim Maximum Acceptable Concentration (IMAC) of 60 ug/L, for atrazine and d-ethyl atrazine in drinking water, was exceeded in one set of raw and treated water samples.

The other pesticides were detected less frequently than atrazine. Nevertheless, when they were found, atrazine was always present. Cyanazine was detected at one location at concentrations ranging from 0.27 to 3.3 ug/L in the raw water and from 0.90 to 3.68 ug/L in the treated water, which was below the H&WC IMAC of 10 ug/L. Metolachlor was detected at three locations. The concentrations ranged from 0.50 to 14.0 ug/L and from 0.55 to 6.65 ug/L in the raw and treated water respectively. The H&WC IMAC of 50 ug/L was not exceeded.

The 1987 results show that pesticide levels at the surface water treatment plants were generally lower than the levels detected in the 1985 and 1986 surveys.

Powdered activated carbon (PAC), used at dosages for taste and odour control (lower than recommended for pesticide removal), did not effectively reduce pesticide levels.

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1.0 CONCLUSIONS

(1) Treated Water: The concentration of one pesticide, atrazine, in one sample, exceeded the H&WC drinking water guideline value of 60 ug/L. The pesticide concentrations in all other samples were well below the applicable guidelines.

(2) Raw Water: The concentration of one pesticide, atrazine, in one sample, was higher than the H&WC drinking water guideline value of 60 ug/L. The pesticide concentrations in all other samples were well below the applicable guidelines.

(3) Pesticide residues were detected in the treated water at almost 70 percent of the selected municipal waterworks surveyed.

(4) Atrazine was the most frequently detected pesticide and was found in 63 percent of the treated water samples. The highest level reported, in one treated water sample, exceeded the H&WC IMAC. All other levels were less than 15 percent of the IMAC. The highest concentrations of atrazine occurred in June.

(5) The highest pesticide concentrations in the raw water, occurred in May, June and July.

(6) A minimum of weekly monitoring is necessary, during peak periods, in order to determine an accurate profile of pesticide occurrences and levels.

(7) All locations showed a significant decrease in the general level of pesticide residues from the 1985 and 1986 surveys.

(8) Powdered activated carbon (PAC), applied at the water treatment plants at dosages lower than recommended for pesticide control, did not effectively reduce pesticide residues in the treated water.

2.0 RECOMMENDATIONS

The recommendations resulting from this limited information follow those of the 1986 pesticide survey:

(1) Monitoring of raw water for pesticides should be conducted during the spring and summer when peak concentrations would be expected.

(2) Monitoring should be conducted on a weekly basis at least during the peak period at those waterworks, such as Dresden, where pesticide residues were found regularly.

(3) Proper PAC facilities for storage and feeding may be necessary at waterworks where pesticide residues are often found.

(4) PAC dosage should be increased from levels sufficient to treat taste and odour (up to 5 mg/L) to as much as 40 to 50 mg/L, during and immediately following heavy rainfall to ensure optimum removal of pesticides from treated water.

(5) Due to the time lag before sample results are obtained, PAC should be added in sufficient dosages during those times of the year when elevated pesticide levels may be present in the raw water.

3.0 INTRODUCTION

A monitoring program, specifically for the detection of pesticides in surface waters, was not conducted by the Ministry of the Environment (MOE) in 1987. However, samples of raw and treated water, collected from a limited number of municipal surface waterworks, were analyzed for pesticides as part of the MOE, Drinking Water Surveillance Program (DWSP), and the Ontario Ministry of Agriculture and Food (OMAF) pesticide monitoring program. The function of this document is to report the pesticide results from the two programs for 1987.

In order to provide continuity to the reporting of pesticide information, the triazine group of pesticides, used widely on corn and soyabean crops in Ontario,[1] were selected from the available data for this report. These herbicides were detected during the 1985 and 1986 pesticide studies.

The analytical data includes the results of either routine or pesticide monitoring at six water treatment plants situated in agricultural areas where pesticides are used extensively. The locations were limited to those sites where positive results were found in 1985 and 1986. Southwestern region was identified as the locality most subsceptible to pesticide contamination because of intense corn and soyabean production.

The number of results from each location varied, depending on the strategy of the programs. The DWSP provided limited results for five locations in Southwestern region, Alvinston, Amherstburg, Dresden, Mitchell's Bay and Wallaceburg, and one location in West Central region, Brantford. The OMAF supplied the results of weekly sampling at the Dresden location.

Table 1 lists the waterworks, the respective surface water sources for each plant, the program designation, and the number of sampling events conducted by the two programs during the year. Figure 1 indicates where in Ontario the waterworks are located.

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[1] Survey of Pesticide Use In Ontario, 1983 - Estimates of Pesticides Used on Field Crops, Fruit and Vegetables (Economics Information Report No. 84-05, 89-08) Ontario Ministry of Agriculture and Food, 1983.

TABLE 1: MUNICIPAL WATERWORKS SAMPLED FOR PESTICIDES, 1987

REGION	WATERWORKS	WATER SOURCE	PROGRAM	NUMBER OF SAMPLINGS DWSP	OMAF
SW	Alvinston	Sydenham River	DWSP	1	-
SW	Amherstburg	Detroit River	DWSP	2	-
SW	Dresden	Sydenham River	DWSP, OMAF	2	36
SW	Mitchell's Bay	Lake St. Clair	DWSP	2	-
SW	Wallaceburg	Chanel Ecarte	DWSP	14	-
WC	Brantford	Grand River	DWSP	1	-

SW - Southwestern WC - West Central

4.0 ANALYTICAL METHODS

Samples of raw and treated water, collected from municipal surface waterworks for the DWSP, were analyzed for pesticides by the MOE, Laboratory Services Branch (LSB) in Toronto.

Pesticide analyses, on raw and treated water samples collected from the Dresden waterworks for the OMAF program, were conducted by the OMAF Pesticide Residue Laboratory in Guelph.

Table 2 lists the pesticides that were analyzed for by the MOE and OMAF, the laboratory detection limits, and the recommended guideline value for each compound. A description of the analytical procedures for both laboratories is given in Appendix 1.

TABLE 2: PARAMETER ANALYSIS LIST, 1987

PARAMETER	DETECTION LIMITS: MOE	OMAF	GUIDELINE	UNITS	REF CODE
Alachlor+	0.50	0.10	5	ug/L	(1)
Ametryne	0.05	-	300	ug/L	(2)
Atratone	0.05	-	-	-	-
Atrazine	0.05	0.10	60 *	ug/L	(3)
D-ethyl atrazine	0.20	0.10	60 *	ug/L	(3)
Cyanazine	0.10	0.10	10	ug/L	(3)
Metolachlor	0.50	0.10	50	ug/L	(3)
Metribuzin (Sencor)	0.10	0.10	80	ug/L	(4)
Prometone	0.05	-	525	ug/L	(2)
Prometryne	0.05	-	1	ug/L	(1)
Propazine	0.05	-	700	ug/L	(2)
Simazine	0.05	-	10 **	ug/L	(3)
D-ethyl simazine	0.20	-	10 **	ug/L	(3)

Note: * Total of Atrazine plus D-ethyl atrazine
** Total of Simazine plus D-ethyl simazine
+ Banned

Guideline Source:

(1) MOE - Pesticides in Ontario Drinking Water - 1985, August 1987
(2) US EPA - Lifetime Health Advisory
(3) H&WC - Interim MAC
(4) H&WC - MAC

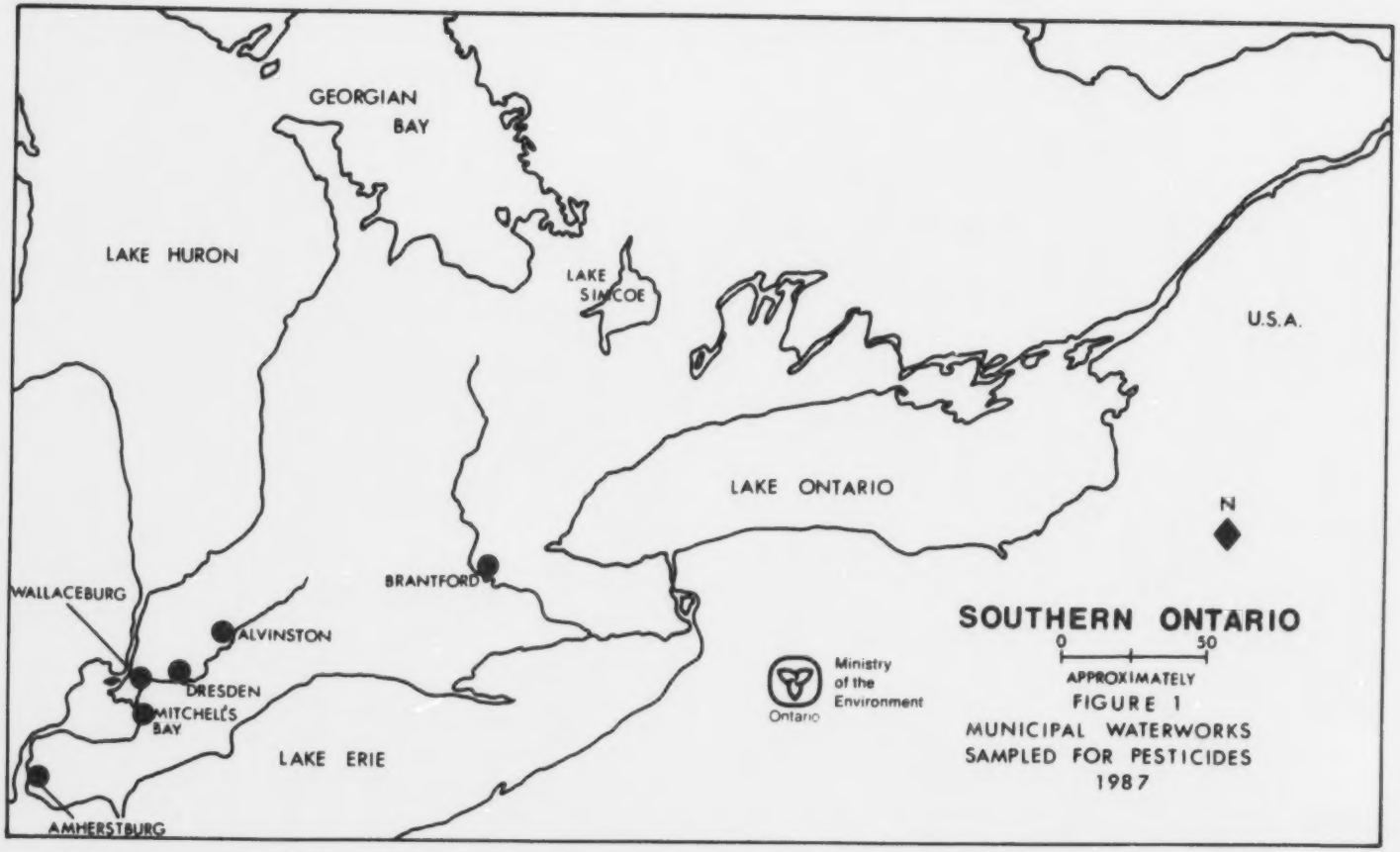

FIGURE 1
MUNICIPAL WATERWORKS
SAMPLED FOR PESTICIDES
1987

5.0 RESULTS AND DISCUSSION

A limited number of municipal waterworks, supplied by surface water sources, were monitored for levels of pesticides in both the raw and treated water. The 1987 information includes results from DWSP and the OMAF pesticide monitoring program. DWSP contributed pesticide results for Alvinston, Amherstburg, Dresden, Mitchell's Bay, Wallaceburg and Brantford. The results of weekly monitoring at Dresden were supplied by the OMAF.

Appendix 2 contains the detailed analysis results for the following pesticides: alachlor, ametryne, atratone, atrazine, cyanazine, d-ethyl atrazine, d-ethyl simazine, metolachlor, prometone, prometryne, propazine, metribuzin (Sencor), and simazine. D-ethyl atrazine and d-ethyl simazine were not analyzed by the MOE in 1987. Also, the OMAF did not test for the parameters ametryne, atratone, prometone and propazine. These pesticides were reported as having no result (NR). Samples that were broken before analysis, or not collected, were described as having no sample (NS).

A summary of the results is given in Table 3. The table indicates the number of samples analyzed, the number of occurrences (samples found to contain positive or trace levels of pesticide), and the range of pesticide concentrations detected, for each of the locations that were sampled.

Analysis was conducted on a total of 113 samples, 56 raw water and 57 treated water samples, from six locations. Four pesticides: atrazine and its metabolite d-ethyl atrazine, cyanazine, and metolachlor were detected at positive or trace levels[1]. None of the other pesticides were detected at any of the sample locations. Of the samples analyzed, only one treated water sample was found to have a level of pesticide (atrazine) that exceeded the applicable guideline value.

Atrazine was detected most frequently and was found at four of the six locations. It was found in 71, or 63 percent, of the 113 samples that were analyzed. The concentrations of atrazine in the raw water ranged from 0.10 to 62 ug/L. Treated water samples were

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[1] The results, as reported by the MOE laboratory, that are less than ten times the analysis detection limit, are reported as "value" <T. These concentrations are considered to be trace quantities of the determined parameter and do not carry the same confidence as values above T.

found to contain atrazine at concentrations ranging from 0.12 to 210 ug/L. This latter value exceeds the H&WC IMAC of 60 ug/L for atrazine in drinking water.

The highest values of atrazine were found at Dresden in May, June and July. Thirty-two, or 86 percent, of the 37 raw water samples that were analyzed, contained the compound at concentrations ranging from 0.1 to 62 ug/L. Atrazine was detected in 33, or 87 percent, of the 38 treated water samples at concentrations of 0.12 to 210 ug/L. Sixty-eight percent of the samples from Dresden that contained atrazine, also contained d-ethyl atrazine. The maximum value of d-ethyl atrazine detected in the treated water was 1.6 ug/L.

At Dresden, the levels of atrazine remained low throughout most of the year. In June, however, higher levels were detected. During the first three samplings in June, concentrations ranged from 11.0 to 14.4 ug/L in the raw water and from 13.9 to 16.0 ug/L in the treated water. The fourth set of samples, taken on June 30 and analyzed by the OMAF, were found to contain atrazine at levels of 62 ug/L in the raw water and 210 ug/L in the treated water. The Dresden plant was notified immediately and re-sampled, but the concentrations had returned to low levels as indicated by the follow-up sample.

Although the raw water turbidity at Dresden on June 30 was low, run-off due to rainfall likely caused the high levels of contamination. The federal Atmospheric Environment Service climatological report for Dresden shows that the total rainfall during the last week of June was 25.2 mm.

Despite the treated water turbidity at Dresden on June 30 being low, it was noted that the conventional treatment process, with the addition of 10 mg/L powdered activated carbon (PAC), was not effective in removing the high level of atrazine.

In June, the Dresden samples also contained cyanazine, metolachlor and low levels of d-ethyl atrazine (as determined by OMAF). These pesticides were found in all four of the raw water samples, but in only one of the treated water samples collected in June. The maximum concentration of cyanazine and metolachlor in the raw water was 3.2 ug/L and 9.02 ug/L respectively. The treated water was found to contain 3.68 ug/L cyanazine and 6.65 ug/L metolachlor. The H&WC IMAC of 10 ug/L for cyanazine and 50 ug/L for metolachlor were not exceeded.

Low levels of atrazine, and also metolachlor, were found at two other locations in June. One set of samples from Alvinston contained 1.72 ug/L atrazine and a trace amount (0.87<T ug/L) of metolachlor in the raw water. The treated water was found to contain 1.7 ug/L atrazine and a trace amount (1.05<T ug/L) of metolachlor.

At Mitchell's Bay, atrazine and metolachlor were detected at trace levels in one set of samples. The raw water contained 0.46<T ug/L atrazine and 1.0<T ug/L metalochlor, while 0.29<T ug/L atrazine and 0.55<T ug/L metolachlor was found in the treated water.

Trace amounts of atrazine were detected at Brantford in one set of raw and treated water samples (0.30<T ug/L and 0.37<T ug/L respectively).

The analysis results show that, the pesticide levels in most of the raw and treated water samples were lower than the levels detected in the 1985 and 1986 pesticide surveys. The lower levels may be due, in part, to the declining usage of triazine herbicides. Some of the pesticides that were not detected are probably not being used to the same extent as the others, and some may not be used at all in Ontario. The registration of alachlor was cancelled by the OMAF in 1985 and therefore its presence in water supplies would not be expected.

Climatic conditions of higher than normal temperatures, in the summer months of 1987, may also be a factor. The process of evaporation, which is enhanced by heat, permits the pesticides to migrate to the soil surface where chemical and microbial degradation occurs.

PAC was being added, prior to chemical treatment, at several of the waterworks in 1987. In most cases, PAC was added for taste and odour control and dosages did not exceed 5 mg/L. The Dresden water treatment plant, however, used PAC at dosages of approximately 20 to 30 mg/L in the first part of June, and after July 8. Equipment problems were experienced at the end of June and during the first week of July, preventing the consistent addition of PAC for the rest of the year. The analysis results for Dresden, in Appendix 2, show that these dosages may have removed low levels of cyanazine and metolachlor from the raw water, but did not appear to reduce the residues of atrazine effectively.

The 1987 data indicates that, monitoring for pesticides should be conducted on a weekly basis, at least during the peak period, at those waterworks where pesticides were found regularly. The Dresden waterworks was sampled 37 times for the OMAF program compared to two samplings conducted under DWSP. The limited DWSP sampling schedule was not adequate to establish an accurate profile of pesticide levels and occurrences.

TABLE 3: PESTICIDES IN RAW AND/OR TREATED WATER AT MUNICIPAL SURFACE WATERWORKS (1987): SUMMARY OF RESULTS

LOCATION		ALAC*	AMET	ATRO	ATRA	CYAN	DATRA	DSIM	MET	PROM	PROY	PROP	SENC	SIM
SOUTHWESTERN REGION														
ALVINSTON														
RAW	Samples	1	1	1	1	1	1	1	1	1	1	1	1	1
	Occurrences	-	-	-	1	0	-	-	1	-	-	-	-	-
	Max	-	-	-	1.72	-	-	-	0.87<T	-	-	-	-	-
	Min	-	-	-	1.72	-	-	-	0.87<T	-	-	-	-	-
TREATED	Samples	1	1	1	1	1	1	1	1	1	1	1	1	1
	Occurrences	-	-	-	1	0	-	-	1	-	-	-	-	-
	Max	-	-	-	1.70	-	-	-	1.05<T	-	-	-	-	-
	Min	-	-	-	1.70	-	-	-	1.05<T	-	-	-	-	-
AMHERSTBURG														
RAW	Samples	2	2	2	2	2	2	2	2	2	2	2	2	2
	Occurrences	0	0	0	0	0	-	-	0	0	0	0	0	0
	Max	-	-	-	-	-	-	-	-	-	-	-	-	-
	Min	-	-	-	-	-	-	-	-	-	-	-	-	-
TREATED	Samples	2	2	2	2	2	2	2	2	2	2	2	2	2
	Occurrences	0	0	0	0	0	-	-	0	0	0	0	0	0
	Max	-	-	-	-	-	-	-	-	-	-	-	-	-
	Min	-	-	-	-	-	-	-	-	-	-	-	-	-
DRESDEN														
RAW	Samples	37	2	2	37	37	35	37	37	2	37	2	37	37
	Occurrences	0	0	0	32	6	24	0	8	0	0	0	0	0
	Max	-	-	-	62	3.30	1.00	-	14.0	-	-	-	-	-
	Min	-	-	-	0.10	0.27	0.09	-	0.50	-	-	-	-	-
TREATED	Samples	38	2	2	38	38	36	38	38	2	38	2	38	38
	Occurrences	0	0	0	33	2	24	0	1	0	0	0	0	0
	Max	-	-	-	210	3.68	1.60	-	6.65	-	-	-	-	-
	Min	-	-	-	0.12	0.90	0.09	-	6.65	-	-	-	-	-

* ALAC (Alachlor) AMET (Ametryne) ATRO (Atratone) ATRA (Atrazine) CYAN (Cyanazine) DATRA (D-ethyl Atrazine) DSIM (D-ethyl Simazine)
MET (Metolachlor) PROM (Pometone) PROY (Prometryne) PROP (Propazine) SENC (Sencor) SIM (Simazine)

Samples: Number of samples analyzed
Occurrences: Number of samples found to contain positive or trace levels of pesticides
Value <T: A Measurable trace amount: tentative
* Units = ug/L

TABLE 3: PESTICIDES IN RAW AND/OR TREATED WATER AT MUNICIPAL SURFACE WATERWORKS (1987): SUMMARY OF RESULTS

LOCATION		ALAC*	AMET	ATRO	ATRA	CYAN	DATRA	DSIM	MET	PROM	PROY	PROP	SENC	SIM
SOUTHWESTERN REGION														
MITCHELL'S BAY														
RAW	Samples	2	2	2	2	2	0	0	2	2	2	2	2	2
	Occurrences	0	0	0	1	0	-	-	1	0	0	0	0	0
	Max	-	-	-	0.46<T	-	-	-	1.00<T	-	-	-	-	-
	Min	-	-	-	0.46<T	-	-	-	1.00<T	-	-	-	-	-
TREATED	Samples	2	2	2	2	2	0	0	2	2	2	2	2	2
	Occurrences	0	0	0	1	0	-	-	1	0	0	0	0	0
	Max	-	-	-	0.29<T	-	-	-	0.55<T	-	-	-	-	-
	Min	-	-	-	0.29<T	-	-	-	0.55<T	-	-	-	-	-
WALLACEBURG														
RAW	Samples	13	13	13	13	13	0	0	13	13	13	13	13	13
	Occurrences	0	0	0	0	0	-	-	0	0	0	0	0	0
	Max	-	-	-	-	-	-	-	-	-	-	-	-	-
	Min	-	-	-	-	-	-	-	-	-	-	-	-	-
TREATED	Samples	13	13	13	13	13	0	0	13	13	13	13	13	13
	Occurrences	0	0	0	0	0	-	-	0	0	0	0	0	0
	Max	-	-	-	-	-	-	-	-	-	-	-	-	-
	Min	-	-	-	-	-	-	-	-	-	-	-	-	-
WEST CENTRAL														
BRANTFORD														
RAW	Samples	1	1	1	1	1	0	0	1	1	1	1	1	1
	Occurrences	0	0	0	1	0	-	-	0	0	0	0	0	0
	Max	-	-	-	0.30<T	-	-	-	-	-	-	-	-	-
	Min	-	-	-	0.30<T	-	-	-	-	-	-	-	-	-
TREATED	Samples	1	1	1	1	1	0	0	1	1	1	1	1	1
	Occurrences	0	0	0	1	0	-	-	0	0	0	0	0	0
	Max	-	-	-	0.37<T	-	-	-	-	-	-	-	-	-
	Min	-	-	-	0.37<T	-	-	-	-	-	-	-	-	-

* ALAC (Alachlor) AMET (Ametryne) ATRO (Atratone) ATRA (Atrazine) CYAN (Cyanazine) DATRA (D-ethyl Atrazine) DSIM (D-ethyl Simazine)
MET (Metolachlor) PROM (Pometone) PROY (Prometryne) PROP (Propazine) SENC (Sencor) SIM (Simazine)

Samples: Number of samples analyzed Occurrences: Number of samples found to contain positive or trace levels of pesticides
Units = ug/L Value <T: A Measurable trace amount: tentative

APPENDIX 1

DESCRIPTION OF ANALYTICAL TECHNIQUE FOR PESTICIDE ANALYSIS

Ministry of the Environment
Ministère de l'Environnement
Ontario

THE DETERMINATION OF TRIAZINE HERBICIDES IN WATER BY GC-TSD

135 St. Clair Avenue West
Suite 100
Toronto, Ontario
M4V 1P5

135, avenue St. Clair ouest
Bureau 100
Toronto (Ontario)
M4V 1P5

1.0 SUMMARY

Triazine herbicides have been used as selective herbicides for several crops, such as corn and soybeans, to name but a couple. Triazine herbicides are also used in the non-agricultural field for industrial weed and brush control. Triazines are highly selective due to their ability to inhibit photosynthesis in specific plants. Triazines are also highly persistent in soil and may interfere with normal crop rotation. Certain crops, such as tobacco and sugar beet, are highly susceptible to triazines.

1.1 Principle of Method

Samples are solvent-extracted, dried and evaporated to dryness. Column clean-up is done if necessary. The extract is examined by gas chromatography using a thermionic specific detector (TSD).

1.1.1 Relationship to Other Methods.

Not applicable.

1.2 Parameters Measured

The triazine herbicides routinely analyzed in the laboratory with their LIS Test Codes are:

Compound	Test Code
Prometone	P2PROM
Atraton	P2ATRO
Propazine	P2PROP
Atrazine	P2ATRA
Prometryne	P2PROY
Simazine	P2SIM
Ametryne	P2AMET
Sencor	P2SENC
Bladex	P2BLAD
Metalachlor	P0MET
Alachlor	P0LASS

Under optimum condition, 8-10 samples may be analyzed for triazines in 2 days. The range of application is from 0.05 µg/L. The results are reported in µg/L or other units depending on concentrations.

1.3 Sample Matrices

Drinking water and drinking water sources such as surface water and groundwater which are not associated with sewage, industrial waste or landfills.

1.4 Sample Requirements

1.4.1 Specifications.

Samples must be collected in 1 L, brown glass bottles with foil- or Teflon-lined screw caps to prevent contamination. These bottles are solvent rinsed prior to use and are labelled, "For Pesticides and PCB Analysis Only". A minimum sample size of 800 mL is required and 860 mL is preferred. Samples should be refrigerated at 4°C to avoid bacterial degradation. No preservatives should be used.

1.4.2 Contingencies.

1.5 Shortcomings

1.5.1 Interferences.

Glassware used for residue level analysis must be thoroughly cleaned by a series of steps using acetone, detergent and water rinses and baking at 300°C. All glassware must be rinsed thoroughly with solvent prior to use.

Even though few interferences are encountered during gas chromatographic analysis, due to the specificity of the thermionic specific detector (TSD), the presence of other nitrogen containing or phosphorous containing compounds may interfere with the analysis and/or confirmations to some extent. Water samples do not require clean-up prior to gas chromatographic analysis.

1.5.2 Biases.

Organic component losses occur during sample processing and are the result of factors which are inherent in any organic extraction technique. Problems such as the formation of emulsions, oxidation and volatization of compounds during extraction as well as evaporation loss during solvent concentration all contribute to some reduction in organic component recovery.

1.5.3 Limitations.

1.6 Analytical Performance Summary

1.6.1 Single Analyst (Within-run) Precision.

Not available.

1.6.2 Between-Run Precision (Standards).

Not applicable.

1.6.3 Between-Run Precision (Typical Samples).

Not applicable.

1.6.4 Inter-Method Comparison.

Not available.

1.6.5 Inter-Lab Comparison (Same Method).

Not available.

1.6.6 Inter-Lab Comparison (Different Method).

Not available.

1.6.7 Method Recovery (Reference Materials).

Not applicable.

1.7 Bibliography

1.7.1 U.S. Environmental Protection Agency; 1976. Analysis of Pesticide Residues in Human and Environmental Samples. Environmental Toxicology Division, Health Effects Laboratory, Research Triangle Park, N.C.

1.7.2 U.S. Department of Health, Education and Welfare; 1965. Guide to the Analysis of Pesticide Residues - Volumes 1 and 2. Public Health Service, Bureau of State Services (Environmental Health), Office of Pesticides, Washington, D.C.

1.8 History of Changes/Revisions

Not available.

2.0 SAMPLE PREPARATION

2.1 Labwares

NOTE: Equipment equivalent to that used in this method is acceptable.

2.1.1 Dispenser, pipettor, adjustable plunger-type, EM Optifix, 50 Ml.

2.1.2 Cylinder, graduated, 1 L.

2.1.3 Pipette, graduated, 25 mL.

2.1.4 Pipette, transfer, volumetric, 1 mL.

2.1.5 Beaker, Pyrex, 100 mL.

2.1.6 Flask, Erlenmeyer, 250 mL.

2.1.7 Ring, cork, 60 mm ID.

2.1.8 Funnel, Pyrex filter, 60 slope with 65 mm top ID and 65 mm stem length.

2.1.9 Flask, round bottom, 250 mL with 24/40 t/s joint.

2.1.10 Pipette, Pasteur, diposable.

2.1.11 Tube, graduated centrifuge, 50 mL.

2.1.12 Vial, screw cap, with Teflon septa.

2.1.13 Pipette, volumetric, 2 mL.

2.1.14 Separators, Phase, Silicone treated, 15 cm, Whatman 1PS.

2.2 Reagents

NOTE: Solvents pose fire and exposure hazards, therefore, extreme care must be taken during their transport, storage and use.

2.2.1 Potassium hydroxide, KOH, concentrated.

2.2.2 Dichloromethane, CH_3Cl_2, distilled-in-glass, Caledon.

2.2.3 Acetone, CH_3COCH_3, reagent grade, Caledon.

2.2.4 Iso-octane, $(CH_3)_3CCH_2CH(CH_3)_2$, (2,2,4-trimethylpentane), distilled-in-glass, Caledon.

2.2.5 Diethyl ether, $(C_2H_5)_2O$, distilled-in-glass, Caledon.

2.2.6 Iso-propanol, $CH_3CHOHCH_3$, distilled-in-glass, Caledon.

2.2.7 Water, distilled, DW.

2.2.8 Chromic acid, H_2CrO_7, reagent grade.

2.2.9 Nitric acid, HNO_3, reagent grade.

2.3 Equipment

2.3.1 Roller, 90-100 rpm.

2.3.2. Evaporator, rotary flask, Buchler.

2.1.4 Vacuum line system, in-house.

2.4 Glassware Preparation

2.4.1 Rinse all glassware, except pipettes, with tap water and run through the dishwasher.

2.4.2 Soak pipettes for 0.5 hours in reagent grade CH_3COCH_3, rinse with tap water and place in surfactant detergent tank.

NOTE: Pipettes are rinsed with H_2CrO_7 weekly.

2.4.3 After soaking in detergent for 0.5 hours, rinse pipettes with tap water followed by DW.

2.4.4 Place all glassware in drying oven set at 300°C for 12 hours.

2.5 Extraction Procedure

All samples undergo an addition of base (KOH) followed by solvent extraction and solvent concentration prior to Gas Chromatographic analysis. The column clean-up step has been eliminated due to the relatively clean nature of the water samples which are being tested.

2.5.1 Samples are received in pre-rinsed, cleaned and labelled 1 L brown glass bottles with Teflon- or foil-lined screw caps.

NOTE: The cleaning procedure involves a detergent washing, a rinsing (with 5% HNO_3), a tap water wash and a DDW water rinsing. The temperature of the water is 80°C.

2.5.2 Shake each sample vigorously, if needed, and discard a portion bringing sample to appropriate volume for extraction (approximately 800 mL). Remove foil liner as it can cause the cap to leak.

2.5.3 Make up one blank and one spike to be processed along with each set of samples. (Blanks consist of 800 mL tap water while spikes consist of 800 mL of tap water containing 1 mL of Spike Solution (see Section 5.2) in CH_3COCH_3 Warm the Spike Solution to room temperature before adding to the bottle.)

2.5.4. Add Potassium Hydroxide Solution to make the samples, spike and blank, basic (pH 12) and check the actual pH with pH or litmus paper (normally only one Pasteur pipette of Potassium Hydroxide Solution is needed). The litmus paper should turn dark blue.

2.5.5 Using the plunger type pipettor dispenser add 80 mL of CH_2Cl_2 to each sample, spike and blank.

2.5.6 Place the bottles on the roller and roll for 30 minutes at 90-100 rpm.

2.5.7 Rinse the 250 mL round bottom flasks and Erlenmeyer flasks with ~25 mL of CH_2Cl_2; swirl the CH_2Cl_2 in the flask and collect the wash in a pre-rinsed round bottom flask. Repeat with second 25 mL aliquot of CH_2Cl_2.

2.5.8 Rinse the 25 mL graduated measuring pipettes with 80 mL of CH_2Cl_2 by drawing CH_2Cl_2 up each pipette and add this wash to the flask wash.

2.5.9 Remove the bottles from the roller and siphon off the lower CH_2Cl_2 layer using a pre-rinsed 25 mL pipette and the in-house vacuum line system. Place the CH_2Cl_2 layer in a labelled, rinsed, Erlenmeyer flask.

NOTE: Care should be taken to ensure that minimal or no water is transferred.

2.5.10 Use one pipette for each sample and leave pipette standing in the appropriate Erlenmeyer flask after the extract is drawn off.

2.5.11 Using a second 80 mL of CH_2Cl_2 followed by 40 mL of CH_2Cl_2. Repeat Steps 2.5.6, 2.5.9, and 2.5.10, adding siphoned extracts to the appropriate Erlenmeyer flask. Samples may be left overnight with the flasks covered by aluminum foil, shiny side down.

2.5.12 If large amounts of water are present in the flask, excess water can be removed using a disposable Pasteur pipette and put back in the 1 L bottle.

2.5.13 Measure the sample volumes by emptying each sample into a 1 L graduated cylinder and noting the volume. Samples are discarded.

2.5.14 Set up the necessary number of filter funnels, with folded phase separator papers (folded radially 4 times to form a cone), in the 250 mL pre-rinsed round bottom flasks resting on cork rings.

2.5.15 Pour approximately 20 mL of CH_2Cl_2 through each filter. The solvent may be used again through a second filter.

2.5.16 Filter the samples, spike and blank from the Erlenmeyer flasks through the phase separator filter into the 250 mL round bottom flasks.

2.5.17 Rinse each Erlenmeyer flask with 10 mL of CH_2Cl_2 and pass the rinse through the appropriate filter funnel.

2.5.18 Add 2 mL of $(CH_3)_3CCH_2CH(CH_3)_2$ to the extracts in the round bottom flasks.

2.5.19 Rinse the rotary flash evaporator with a small amount of CH_2Cl_2 before evaporating any samples. Set up the 250 mL round bottom flasks containing sample, spike, blank or glassware rinse on the rotary flash evaporator and concentrate to approximately 1 mL. (The remaining liquid is approximately the size of a quarter.)

2.5.20 Add 5 mL of $(CH_3)_3CCH_2CH(CH_3)_2$ to each flask. Evaporate to dryness on the rotary evaporator.

2.5.21 Add 2 mL of $CH_3CHOHCH_3$ using an Eppendorf pipette to each round bottom flask. Use an separate pipette tip for each sample. Use the individual pipette to rinse down the sides of the round bottom flask with the 2 mL of $CH_3CHOHCH_3$. Let the sample sit for about 5 minutes before transferring the extract to the screw cap vials for Gas Chromatographic analysis.

3.0 ANALYTICAL PROCESSING

Water samples do not normally need to be processed through the Clean-up procedure as they are 'clean' samples, and are ready for submission to the Detection System after extraction.

4.0 DETECTION SYSTEM

4.1 Labwares

None required.

4.2 Reagents

4.2.1 Gas, carrier, ultra pure nitrogen, 4 mL/minute.

4.2.2 Gas, make-up, ultra pure nitrogen, 30 mL/minute.

4.2.3 Gases, flame, extra dry air, 175 mL/minute; pre-purified hydrogen, 4.5 mL/minute.

4.3 Equipment

4.3.1 Traps, gas: hydrocarbon; oxygen; and moisture.

4.3.2 Chromatograph, Gas, Varian, Model 3700.

4.3.3 Columns, Dual Capillary, fused silica:

30 m DBWAX: .25 mm bore
.25 µm coating
30 m DB1701: .25 mm bore
.25 µm coating.

4.3.4 Detectors, TDS, dual.

4.4 Gas Chromatographic Analysis Procedure

4.4.1 Check all the gas cylinders to ensure that the pressure will not drop below 500 psi for the number of samples expected to be run.

4.4.2 Check the chart paper and storage disk space to ensure that a sufficient supply is available to complete the run.

4.4.3 Check the program for the Gas Chromatograph.

4.4.4 Set the baseline on the Gas Chromatograph to zero, if applicable.

4.4.5 Check the syringe alignment and volume.

4.4.6 All instrument problems should be noted in the instrument logbook including method changes, modifications to the instrument, changes of columns, septa, traps, etc.

4.4.7 The injection septa of each Gas Chromatograph must be changed every week, or when problems arise thought to be due to poor septum performance. If a Gas Chromatograph is

to be left idle for more than half a day, the temperature of the oven should be left at 200°C after the final sample has been run.

4.4.8 The following traps must be inserted in the corresponding gas lines and changed every three months:

Gas	Traps
nitrogen (for autosampler)	charcoal
nitrogen (for makeup)	charcoal/molecular sieve/ oxygen
helium	oxygen/charcoal/molecular sieve
air	charcoal/molecular sieve
hydrogen	charcoal/molecular sieve/ oxygen.

4.4.9 Settings for the Gas chromatograph.

Attenuation:	1×10^{-12}
Injector Temperature:	200°C.
Detector Temperature:	300°C.
Temperature Program:	Initial 100°C for 0 minutes
:	Rate 4°C/minute
:	Final 240°C for 2 minutes.

5.0 CALIBRATION AND STANDARDIZATION

5.1 Labwares

5.1.1 Flask, volumetric, 100 mL.

5.2 Standards and Reference Materials

Standards are stored in the freezer. Standard solutions are stored in a cool, dark place. Standards are disposed of by pouring them into an empty 4 L solvent bottle. This bottle is appropriately labelled by the supervisor and sent to Tricil.

5.2.1 Acetone, CH_3COCH_3, distilled-in-glass, Caledon.

5.2.2 Iso-octane, $(CH_3)_3CCH_2CH(CH_3)_2$, distilled-in-glass, Caledon.

5.2.3 Test Component Stock Solutions (100 µg/mL made from material not less than 95% pure).

Dissolve 0.010 g of the individual herbicides (listed in Table 1) in 10 mL of CH_3COCH_3 and make up to 100 mL in individual volumetric flasks with CH_3COCH_3.

5.2.4 Test Component Standard Mix (ng/mL).

In a volumetric flask, dilute an appropriate aliquot of each Stock Solution (100 µg/mL prepared in Section 5.2.4) serially with $(CH_3)_3CCH_2CH(CH_3)_2$ to give the final mixture concentrations listed in Table 1 as "Injection Standard".

5.2.5 Spike Solution.

Dilute the required aliquot of each Stock Solution (100 µg/mL) in a 100 mL volumetric flask with CH_3COCH_3, to give the final concentration listed in Table 1 as "Spiking Standard".

NOTE: The same Stock Solutions (see Section 5.2.3) are used for the Spike Solution as are used for the Test Component Standard (Injection Standard).

TABLE 1 SPIKING SOLUTIONS

Compound	Minimum Measurable Value ppt	Injection Standard ng/mL	Spiking Standard ng/mL
Prometone	50	500	200
Atraton	50	500	200
Propazine	50	500	200
Atrazine	50	500	200
Prometryne	50	500	200
Simazine	50	500	200
Ametryne	50	500	200
Sencor	100	1000	400
Bladex	100	500	200
Metalachlor	500	2500	1000
Alachlor	500	2500	1000

5.3 Equipment

5.3.1 Balance, analytical, accurate to ±1 mg.

5.4 Calibration Procedure

5.4.1 Make a solvent ($(CH_3)_3CCH_2CH(CH_3)_2$) injection to insure that no interferences are present on the column.

5.4.2 Inject the Test Component Standard (storing raw data). All peaks should be sharp with little or no tailing.

5.4.3 If the retention times have changed for any of the Standards, the new time must be inserted in the computer. Set percent, update at 10%. All peaks should be updated to the proper concentration. (e.g., If Prometon was found to be 490 ng/mL, the computer will update the concentration to 500 ng/mL, based on the new retention time.) If some of the peaks are not updated, the chromatogram should be checked to ensure that the peak is properly identified and the retention times have not changed. Individual Standards must be run if there is any doubt. A second Standard should be run to make sure the system is stable if the retention times are manually updated. Samples now ready to be run.

6.0 RUN PROCESSING AND QUALITY ASSURANCE

6.1 Run Format

6.1.1 Run the Test Component Standard Mix on the Varian Model 3700 Gas Chromatograph against Methods TRI 1 and TRI 2. ('Methods' are procedures programmed into the Vista 402 microcomputer). Check retention times and response factors for each component.

6.1.2 Using the Test Component Standard Mix (which was saved on the disc), recalibrate the instrument adjusting data response factors and retention times.

6.1.3 Place screw cap vials containing samples, spikes, blanks and glassware rinses on the autosampler the gas chromatograph. Enter the appropriate dilutions and sample numbers in the Vista 402 System workstation.

6.1.4 Run the samples, spikes and blanks and interpret resulting chromatograms to establish the presence/absence of components and, in turn, quantify any components present.

6.1.5 The run format is as follows:

Solvent (iso-octane)
Calibration Standard #1
Blank
Spike
Glassware rinse
Samples 1 - 10
Standard #1
Standard #2
Solvent
Samples 11 - 20
Standard #1
Standard #2
Solvent
Samples 21 - 30
etc.

NOTE: The run format should be recorded in the instrument logbook, including dilution factors used and current date, and the instrument the samples are run on, the method used, and rack and vial.

NOTE: Standard #2 is to be made up independently of Standard #1 and both are to be checked against the equivalent standard of Trace Organics Section.

NOTE: Standards and a solvent blank are run at the end of the daily run.

6.2 Run Control Operations/Limits

6.2.1 Blanks and spikes should be run with the samples with which they were extracted, whenever possible.

6.2.2 Blank values must be subtracted from the sample values extracted simultaneously.

6.2.3 Glassware rinses are not subtracted but are used as a guide to indicate glassware cleaning problems.

6.2.4 The baseline and noise of the instrument must be plotted each day.

6.2.5 When the Standard or Spiking Solution is changed, the new Standard must be compared, in triplicate, with the old and the relevent chromatograms stored in a Standard file. The date of this change must be documented. The new peak area must be less than 20% different from the current peak area.

6.2.6 A new Working Standard for organophosphorous pesticides, and polynuclear aromatic hydrocarbons is prepared from an Intermediate Combined Solution at approximately 6-month intervals, or when the volume of the Standard drops by more than one-third in the 100 mL volumetirc flask, whichever is sooner.

6.2.7 For all other analytical tests, a new Working Standard is prepared from an Intermediate Combined Solution when the volume of the previous Standard drops by more than one-third in the 100 mL volumetric flask.

6.2.8 For all analytical tests, the new Injection/Spiking Standard is analyzed in triplicate relative to a calibration generated using the previous Standard.

6.2.9 The average response is compared as a ratio of area counts for each compound in the Standard, with an acceptance limit of 20% difference.

6.2.10 The results of the comparison are recorded on the Validation of Organic Standard Solution form stored in the Organic Water Unit Standards binder.

6.2.11 The relevant chromatograms are stored in the corresponding Standards file, the date of change is recorded, and the Standard is signed off for use by the senior technical staff, scientist or supervisor.

6.2.12 In cases where the 20% acceptance criteria are not met, a new Working Standard is obtained by performing the appropriate dilution from a new Intermediate Combined Solution.

6.2.13 When the second Working Standard fails to meet the acceptance criteria, new individual Concentrated Stock Solutions are prepared for the parameter(s) which fall outside the 20% difference limit. The average area counts for these parameters are recorded and deviations from previous Standards are noted.

6.3 Calculation Procedure

6.3.1 Results are obtained from peak areas based on the following formula:

$$\text{result in sample} = \frac{\text{area X factor}}{\text{divisor X 10000}} \text{ X multiplier}$$

NOTE: Amount Standard, divisor and multiplier are all preset by the operator of the Data System. The divisor or multiplier is used to convert the concentration back to the concentration in the original sample.

6.3.2 Calibration factors (cf) convert the measured area for a compound into the amount present. Calibration factors are calculated during a calibration run using the formula:

$$\text{cf component} = \frac{\text{amount Standard}}{\text{area Standard}}$$

The stored calibration factors are then used in subsequent analysis runs to calculate the final results using the formula:

amounts in sample = area in sample X cf of component

The calibration factors are absolute factors based on precise repetitive injection of the same sample size. The Varian Vista 402 Data System calculates the final results using slightlty modified versions of the above formulas.

$$\text{factor component} = \frac{\text{(amount in the Standard)(amount of the Standard)}}{\text{area in the Standard}} \text{X } 10000$$

6.3.3 In order for a peak to be accepted as a valid component of a sample, the following must be provided:

i) the peak must be identified on both columns.
ii) the time offset is less than 0.1 minute on both columns.
iii) the difference in the offset of the two columns is absolutely less than 0.03 minutes.

iv) there is an identifiable peak on the chromatograms at the retention times quoted and the area noted roughly in proportion to the area of a peak in an uncluttered portion of the chromatogram.

6.4 Reporting

6.4.1 The concentrations calculated for each column are averaged if the larger concentration is less than 1.5 times the smaller. If the larger concentration is greater than this value, it is assumed that there is an interference and the lower concentration is reported.

6.4.2 It is the responsibility of the person doing the submission approval to ensure, as far as possible, that the results reported are those actually in the sample sent in to the laboratory.

6.4.3 Detection criteria in µg/L are as follows:

Prometone	0.05	Simazine	0.05
Atraton	0.05	Ametryne	0.05
Propazine	0.05	Sencor	0.10
Atrazine	0.05	Bladex	0.10
Prometryne	0.05	Metalachlor	0.50
Alachlor	0.50		

6.4.5 Des Ethyl Atrazine (LIS Test Code P2DATR) and Des Ethyl Simazine (LIS Test Code P2DSIM) are also detected by this scan.

6.5 Proficiency Testing

6.5.1 New technicians practice doing extractions on blanks and spikes before extracting any samples.

Ontario

Ministry of Agriculture and Food

Ministère de l'Agriculture et de l'Alimentation

Pesticide Residue Laboratory
Building 43, McGilvray Street
c/o University of Guelph
Guelph, Ontario N1G 2W1
Telephone (519) 823-8800 Ext. 4825

Laboratoire d'analyse des résidus de pesticides
Édifice 43, rue McGilvray
Université de Guelph
Guelph (Ontario) N1G 2W1
Tél: (519) 823-8800, poste 4825

12 December 1989

The method used for our herbicide screen is that as described on the attached page. Gas chromatographic analysis was performed primarily on capillary machines with packed column machines used as alternates. Conditions are indicated on a separate page which is also enclosed.

The following indicates various recoveries for acetanilide and triazine herbicides routinely analyzed in our herbicide scan. The acetanilides which include alachlor and metolachlor have recoveries from 92 to 109% with standard deviations of 6.4 to 8.2 at fortification levels of 0.25 to 20 ug L^{-1} (ppb). Triazines which include atrazine, d-atrazine, simazine, d-simazine, prometryn and metribuzin show recoveries ranging from 72 to 112% with a maximum standard deviation of 12% over the fortification range of 0.125 to 10 ug L^{-1} (ppb). Cyanazine is slightly more variable and ranges from 102 to 124% over the range of 0.25 to 20 ug L^{-1} (ppb) with a standard deviation which ranges from 12 to 16%. Our detection limit for these herbicides in water is 0.1 ppb.

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Ontario

Ministry of Agriculture and Food

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Pesticide Residue Laboratory
Building 43, McGilvray Street
c/o University of Guelph
Guelph, Ontario N1G 2W1
Telephone (519) 823-8800 Ext. 4825

Laboratoire d'analyse des résidus de pesticides
Édifice 43, rue McGilvray
Université de Guelph
Guelph (Ontario) N1G 2W1
Tél: (519) 823-8800, poste 4825

EXTRACTION OF TRIAZINE RESIDUES IN WATER

1. Transfer a measured volume (approx 1000 mL) of sample water into a 2000 mL sep. funnel.
2. Adjust pH to 9 by adding a few drops of ammonium hydroxide (dil 1:2.5).
3. Add 100 mL of chloroform ($CHCl_3$).
4. Let layers separate, then drain the chloroform phase through a piece of $CHCl_3$ pre-washed and dried cotton into a 500 mL boiling flask.
5. Repeat extraction with 100 mL of $CHCl_3$.
6. Evaporate the combined $CHCl_3$ extracts on a rotary evaporator (50-60°C water bath) almost to dryness.
7. Add to the residue 10 mL of iso-octane and continue evaporation to dryness.
8. Dissolve the triazine residue in 5 mL of methanol.
9. Use for GLC system to quantitate the residues.

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Experimental Conditions and Equipment

Gas Chromatograph:	Perkin-Elmer 8320B Capillary	
Detector:	Nitrogen/Phosphorus	
Column:	J & W SE54 0.25 mm x 15 m 0.25 um film thickness Chromatographic Specialties	
Carrier Gas:	He 20 psi head pressure 30 cm sec^{-1} linear velocity	
Oven Profile:	Temperature 1	60°C
	Hold	1 minute
	Ramp Rate 1	20° min^{-1}
	Temperature 2	150°
	Hold	0 minute
	Ramp Rate 2	5°C min^{-1}
	Temperature 3	220°C
	Hold	2 minutes
Injector Temperature:		225°C
Dector Temperature:		300°C
Injection:	2 ul, split 10:1	
Alternate:	Tracor 550 Gas Chromatograph Hall Detector - Nitrogen Mode Packed Column: 2.0 mm ID x 1.2 m Carbowax 20 M @ 190°C isothermal.	

APPENDIX 2

1987 PESTICIDE ANALYSIS RESULTS

PESTICIDES IN ONTARIO SURFACE WATER SUPPLIES (1987): DWSP RESULTS REGION: SOUTHWESTERN LOCATION: ALVINSTON

YR MO DY	TYPE	ALCH	AMET	ATRO	ATRA	CYAN	DATRA	DSIM	MET	PROM	PROY	PROP	SENC	SIM
87 01	R	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 01	T	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 02	R	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 02	T	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 03	R	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 03	T	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 04	R	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 04	T	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 05	R	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 05	T	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 06 15	R	BDL	BDL	BDL	1.72	BDL	NR	NR	0.87 <T	BDL	BDL	BDL	BDL	BDL
87 06 15	T	BDL	BDL	BDL	1.70	BDL	NR	NR	1.05 <T	BDL	BDL	BDL	BDL	BDL
87 07	R	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 07	T	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 08	R	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 08	T	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 09	R	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 09	T	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 10	R	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 10	T	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 11	R	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 11	T	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 12	R	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 12	T	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

NOTE: Units = ug/L Type R - Raw T - Treated BDL - Below Detection Limit NR - No Result NS - No Sample <T - A measurable trace amount: tentative

ALCH - Alachlor
AMET - Ametryne
ATRO - Atratone
ATRA - Atrazine
CYAN - Cyanazine
DATRA - D-ethyl Atrazine
DSIM - D-ethyl Simazine
MET - Metolachlor
PROM - Prometone
PROY - Prometryne
PROP - Propazine
SENC - Sencor (Metribuzin)
SIM - Simazine

PESTICIDES IN ONTARIO SURFACE WATER SUPPLIES (1987): DWSP RESULTS REGION: SOUTHWESTERN LOCATION: AMHERSTBURG

YR MO DY	TYPE	ALCH	AMET	ATRO	ATRA	CYAN	DATRA	DSIM	MET	PROM	PROY	PROP	SENC	SIM
87 01	R	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 01	T	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 02	R	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 02	T	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 03	R	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 03	T	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 04	R	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 04	T	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 05	R	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 05	T	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 06 12	R	BDL	BDL	BDL	BDL	BDL	NR	NR	BDL	BDL	BDL	BDL	BDL	BDL
87 06 12	T	BDL	BDL	BDL	BDL	BDL	NR	NR	BDL	BDL	BDL	BDL	BDL	BDL
87 07	R	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 07	T	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 08	R	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 08	T	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 09	R	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 09	T	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 10	R	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 10	T	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 11 30	R	BDL	BDL	BDL	BDL	BDL	NR	NR	BDL	BDL	BDL	BDL	BDL	BDL
87 11 30	T	BDL	BDL	BDL	BDL	BDL	NR	NR	BDL	BDL	BDL	BDL	BDL	BDL
87 12	R	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 12	T	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

NOTE: Units = ug/L Type R - Raw T - Treated BDL - Below Detection Limit NR - No Result NS - No Sample <T - A measurable trace amount: tentative

ALCH - Alachlor
AMET - Ametryne
ATRO - Atratone
ATRA - Atrazine
CYAN - Cyanazine
DATRA - D-ethyl Atrazine
DSIM - D-ethyl Simazine
MET - Metolachlor
PROM - Prometone
PROY - Prometryne
PROP - Propazine
SENC - Sencor (Metribuzin)
SIM - Simazine

PESTICIDES IN ONTARIO SURFACE WATER SUPPLIES (1987): OMAF AND DWSP RESULTS REGION: SOUTHWESTERN LOCATION: DRESDEN

YR MO DY	TYPE	ALCH	AMET	ATRO	ATRA	CYAN	DATRA	DSIM	MET	PROM	PROY	PROP	SENC	SIM
87 01 07	R	BDL	NR	NR	0.10	BDL	BDL	BDL	BDL	NR	BDL	NR	BDL	BDL
87 01 07	T	BDL	NR	NR	0.12	BDL	BDL	BDL	BDL	NR	BDL	NR	BDL	BDL
87 01 15	R	BDL	NR	NR	BDL	BDL	BDL	BDL	BDL	NR	BDL	NR	BDL	BDL
87 01 15	T	BDL	NR	NR	BDL	BDL	BDL	BDL	BDL	NR	BDL	NR	BDL	BDL
87 01 29	R	BDL	NR	NR	0.53	BDL	0.38	BDL	BDL	NR	BDL	NR	BDL	BDL
87 01 29	T	BDL	NR	NR	0.54	BDL	0.43	BDL	BDL	NR	BDL	NR	BDL	BDL
87 02 04	R	BDL	NR	NR	0.38	BDL	0.28	BDL	BDL	NR	BDL	NR	BDL	BDL
87 02 04	T	BDL	NR	NR	0.33	BDL	0.26	BDL	BDL	NR	BDL	NR	BDL	BDL
87 02 25	R	BDL	NR	NR	0.23	BDL	0.10	BDL	BDL	NR	BDL	NR	BDL	BDL
87 02 25	T	BDL	NR	NR	0.38	BDL	0.34	BDL	BDL	NR	BDL	NR	BDL	BDL
87 03 05	R	BDL	NR	NR	0.93	BDL	0.31	BDL	BDL	NR	BDL	NR	BDL	BDL
87 03 05	T	BDL	NR	NR	1.50	BDL	0.62	BDL	BDL	NR	BDL	NR	BDL	BDL
87 03 19	R	BDL	NR	NR	0.33	BDL	0.26	BDL	BDL	NR	BDL	NR	BDL	BDL
87 03 19	T	BDL	NR	NR	0.33	BDL	0.26	BDL	BDL	NR	BDL	NR	BDL	BDL
87 03 24	R	BDL	NR	NR	BDL	BDL	BDL	BDL	BDL	NR	BDL	NR	BDL	BDL
87 03 24	T	BDL	NR	NR	BDL	BDL	BDL	BDL	BDL	NR	BDL	NR	BDL	BDL
87 03 31	R	BDL	NR	NR	0.30	BDL	0.28	BDL	BDL	NR	BDL	NR	BDL	BDL
87 03 31	T	BDL	NR	NR	0.44	BDL	0.30	BDL	BDL	NR	BDL	NR	BDL	BDL
87 04 08	R	BDL	NR	NR	0.70	BDL	0.38	BDL	BDL	NR	BDL	NR	BDL	BDL
87 04 08	T	BDL	NR	NR	0.64	BDL	0.31	BDL	BDL	NR	BDL	NR	BDL	BDL
87 04 14	R	BDL	NR	NR	0.32	BDL	BDL	BDL	BDL	NR	BDL	NR	BDL	BDL
87 04 14	T	BDL	NR	NR	BDL	BDL	BDL	BDL	BDL	NR	BDL	NR	BDL	BDL
87 04 23	R	BDL	NR	NR	0.43	BDL	0.28	BDL	BDL	NR	BDL	NR	BDL	BDL
87 04 23	T	BDL	NR	NR	0.36	BDL	0.12	BDL	BDL	NR	BDL	NR	BDL	BDL
87 04 28	R	BDL	NR	NR	0.31	BDL	0.34	BDL	BDL	NR	BDL	NR	BDL	BDL
87 04 28	T	BDL	NR	NR	0.40	BDL	0.38	BDL	BDL	NR	BDL	NR	BDL	BDL
87 05 07	R	BDL	NR	NR	BDL	BDL	BDL	BDL	BDL	NR	BDL	NR	BDL	BDL
87 05 07	T	BDL	NR	NR	0.17	BDL	BDL	BDL	BDL	NR	BDL	NR	BDL	BDL
87 05 21	R	BDL	NR	NR	0.21	BDL	0.10	BDL	0.94	NR	BDL	NR	BDL	BDL
87 05 21	T	BDL	NR	NR	0.28	BDL	0.13	BDL	BDL	NR	BDL	NR	BDL	BDL

NOTE: Units = ug/L Type R - Raw T - Treated BDL - Below Detection Limit NR - No Result <T - A measurable trace amount: tentative
* - DWSP

ALCH - Alachlor ATRA - Atrazine DSIM - D-ethyl Simazine PROY - Prometryne SIM - Simazine
AMET - Ametryne CYAN - Cyanazine MET - Metolachlor PROP - Propazine
ATRO - Atratone DATRA - D-ethyl Atrazine PROM - Prometone SENC - Sencor (Metribuzin)

PESTICIDES IN ONTARIO SURFACE WATER SUPPLIES (1987): OMAF AND DWSP RESULTS REGION: SOUTHWESTERN LOCATION: DRESDEN (Cont'd)

YR MO DY	TYPE	ALCH	AMET	ATRO	ATRA	CYAN	DATRA	DSIM	MET	PROM	PROY	PROP	SENC	SIM
87 06 02	R	BDL	NR	NR	14.00	2.60	1.00	BDL	14.00	NR	BDL	NR	BDL	BDL
87 06 02	T	BDL	NR	NR	16.00	BDL	1.60	BDL	BDL	NR	BDL	NR	BDL	BDL
87 06 10	R	BDL	NR	NR	11.00	3.30	0.60	BDL	13.00	NR	BDL	NR	BDL	BDL
87 06 10	T	BDL	NR	NR	14.00	BDL	0.80	BDL	BDL	NR	BDL	NR	BDL	BDL
87 06 15 *	R	BDL	BDL	BDL	14.40	3.20	NR	NR	9.02	BDL	BDL	BDL	BDL	BDL
87 06 15 *	T	BDL	BDL	BDL	13.90	3.68	NR	NR	6.65	BDL	BDL	BDL	BDL	BDL
87 06 30	R	BDL	NR	NR	62.00	0.36	0.28	BDL	1.10	NR	BDL	NR	BDL	BDL
87 06 30	T	BDL	NR	NR	210.00	BDL	0.26	BDL	BDL	NR	BDL	NR	BDL	BDL
87 07 03	R	BDL	NR	NR	1.80	0.27	0.20	BDL	0.87	NR	BDL	NR	BDL	BDL
87 07 03	T	BDL	NR	NR	1.30	BDL	0.14	BDL	BDL	NR	BDL	NR	BDL	BDL
87 07 08	R	BDL	NR	NR	0.64	BDL	0.19	BDL	0.50	NR	BDL	NR	BDL	BDL
87 07 08	T	BDL	NR	NR	1.10	BDL	0.22	BDL	BDL	NR	BDL	NR	BDL	BDL
87 07 21	R	BDL	NR	NR	0.41	BDL	0.15	BDL	BDL	NR	BDL	NR	BDL	BDL
87 07 21	T	BDL	NR	NR	0.29	BDL	0.18	BDL	BDL	NR	BDL	NR	BDL	BDL
87 07 30	R	BDL	BDL	BDL	0.29	BDL	0.22	BDL	BDL	NR	BDL	NR	BDL	BDL
87 07 30	T	BDL	BDL	BDL	0.33	BDL	0.21	BDL	BDL	NR	BDL	NR	BDL	BDL
87 08 06	R	BDL	BDL	BDL	0.63	BDL	0.10	BDL	0.64	NR	BDL	NR	BDL	BDL
87 08 06	T	BDL	BDL	BDL	0.36	BDL	0.13	BDL	BDL	NR	BDL	NR	BDL	BDL
87 08 11	R	NR	NR	NR	NR	NR	NR	NR	NR	NR	BDL	NR	NR	NR
87 08 11	T	BDL	BDL	BDL	1.07	BDL	0.14	BDL	BDL	NR	BDL	NR	BDL	BDL
87 08 27	R	BDL	BDL	BDL	1.00	BDL	BDL	BDL	BDL	NR	BDL	NR	BDL	BDL
87 08 27	T	BDL	BDL	BDL	1.20	BDL	BDL	BDL	BDL	NR	BDL	NR	BDL	BDL
87 09 03	R	BDL	BDL	BDL	0.97	BDL	BDL	BDL	BDL	NR	BDL	NR	BDL	BDL
87 09 03	T	BDL	BDL	BDL	0.99	BDL	BDL	BDL	BDL	NR	BDL	NR	BDL	BDL
87 09 16	R	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NR	BDL	NR	BDL	BDL
87 09 16	T	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NR	BDL	NR	BDL	BDL
87 09 24	R	BDL	BDL	BDL	0.99	BDL	BDL	BDL	BDL	NR	BDL	NR	BDL	BDL
87 09 24	T	BDL	BDL	BDL	0.97	BDL	BDL	BDL	BDL	NR	BDL	NR	BDL	BDL
87 09 30	R	BDL	BDL	BDL	0.23	BDL	BDL	BDL	BDL	NR	BDL	NR	BDL	BDL
87 09 30	T	BDL	BDL	BDL	0.28	BDL	BDL	BDL	BDL	NR	BDL	NR	BDL	BDL

NOTE: Units = ug/L Type R - Raw T - Treated BDL - Below Detection Limit NR - No Result <T - A measurable trace amount: tentative
* - DWSP

ALCH - Alachlor ATRA - Atrazine DSIM - D-ethyl Simazine PROY - Prometryne SIM - Simazine
AMET - Ametryne CYAN - Cyanazine MET - Metolachlor PROP - Propazine
ATRO - Atratone DATRA - D-ethyl Atrazine PROM - Prometone SENC - Sencor (Metribuzin)

PESTICIDES IN ONTARIO SURFACE WATER SUPPLIES (1987): OMAF AND DWSP RESULTS REGION: SOUTHWESTERN LOCATION: DRESDEN (Cont'd)

YR	MO	DY		TYPE	ALCH	AMET	ATRO	ATRA	CYAN	DATRA	DSIM	MET	PROM	PROY	PROP	SENC	SIM
87	10	06		R	BDL	BDL	BDL	0.94		BDL	0.24	BDL	BDL	NR	BDL	NR	BDL	BDL
87	10	06		T	BDL	BDL	BDL	0.98		BDL	0.24	BDL	BDL	NR	BDL	NR	BDL	BDL
87	10	15		R	BDL	BDL	BDL	0.33		BDL	0.12	BDL	BDL	NR	BDL	NR	BDL	BDL
87	10	15		T	BDL	BDL	BDL	0.43		BDL	BDL	BDL	BDL	NR	BDL	NR	BDL	BDL
87	10	20		R	BDL	BDL	BDL	0.34		BDL	0.09	BDL	BDL	NR	BDL	NR	BDL	BDL
87	10	20		T	BDL	BDL	BDL	0.30		BDL	0.09	BDL	BDL	NR	BDL	NR	BDL	BDL
87	10	28		R	BDL	BDL	BDL	1.70		BDL	0.23	BDL	BDL	NR	BDL	NR	BDL	BDL
87	10	28		T	BDL	BDL	BDL	1.40		BDL	0.17	BDL	BDL	NR	BDL	NR	BDL	BDL
87	11	02	*	R	BDL	BDL	BDL	BDL		BDL	NR	NR	BDL	BDL	BDL	BDL	BDL	BDL
87	11	02	*	T	BDL	BDL	BDL	BDL		BDL	NR	NR	BDL	BDL	BDL	BDL	BDL	BDL
87	11	18		R	BDL	BDL	BDL	0.70		BDL	0.10	BDL	BDL	NR	BDL	NR	BDL	BDL
87	11	18		T	BDL	BDL	BDL	1.10		BDL	0.28	BDL	BDL	NR	BDL	NR	BDL	BDL
87	11	26		R	BDL	BDL	BDL	0.90		BDL	0.56	BDL	BDL	NR	BDL	NR	BDL	BDL
87	11	26		T	BDL	BDL	BDL	0.66		BDL	0.33	BDL	BDL	NR	BDL	NR	BDL	BDL
87	12	02		R	BDL	BDL	BDL	2.40	0.40		BDL	BDL	BDL	NR	BDL	NR	BDL	BDL
87	12	02		T	BDL	BDL	BDL	6.20	0.90		BDL	BDL	BDL	NR	BDL	NR	BDL	BDL

NOTE: Units = ug/L Type R - Raw T - Treated BDL - Below Detection Limit NR - No Result <T - A measurable trace amount: tentative
* - DWSP

ALCH - Alachlor ATRA - Atrazine DSIM - D-ethyl Simazine PROY - Prometryne SIM - Simazine
AMET - Ametryne CYAN - Cyanazine MET - Metolachlor PROP - Propazine
ATRO - Atratone DATRA - D-ethyl Atrazine PROM - Prometone SENC - Sencor (Metribuzin)

PESTICIDES IN ONTARIO SURFACE WATER SUPPLIES (1987): DWSP RESULTS REGION: SOUTHWESTERN LOCATION: MITCHELL'S BAY

YR MO DY	TYPE	ALCH	AMET	ATRO	ATRA	CYAN	DATRA	DSIM	MET	PROM	PROY	PROP	SENC	SIM
87 01	R	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 01	T	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 02	R	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 02	T	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 03	R	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 03	T	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 04	R	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 04	T	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 05	R	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 05	T	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 06 08	R	BDL	BDL	BDL	0.46 <T	BDL	NR	NR	1.00 <T	BDL	BDL	BDL	BDL	BDL
87 06 08	T	BDL	BDL	BDL	0.29 <T	BDL	NR	NR	0.55 <T	BDL	BDL	BDL	BDL	BDL
87 07	R	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 07	T	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 08	R	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 08	T	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 09	R	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 09	T	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 10	R	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 10	T	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 11 09	R	BDL	BDL	BDL	BDL	BDL	NR	NR	BDL	BDL	BDL	BDL	BDL	BDL
87 11 09	T	BDL	BDL	BDL	BDL	BDL	NR	NR	BDL	BDL	BDL	BDL	BDL	BDL
87 12	R	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 12	T	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

NOTE: Units = ug/L Type R - Raw T - Treated BDL - Below Detection Limit NR - No Result NS - No Sample <T - A measurable trace amount: tentative

ALCH - Alachlor
AMET - Ametryne
ATRO - Atratone
ATRA - Atrazine
CYAN - Cyanazine
DATRA - D-ethyl Atrazine
DSIM - D-ethyl Simazine
MET - Metolachlor
PROM - Prometone
PROY - Prometryne
PROP - Propazine
SENC - Sencor (Metribuzin)
SIM - Simazine

PESTICIDES IN ONTARIO SURFACE WATER SUPPLIES (1987): DWSP RESULTS REGION: SOUTHWESTERN LOCATION: WALLACEBURG

YR MO DY	TYPE	ALCH	AMET	ATRO	ATRA	CYAN	DATRA	DSIM	MET	PROM	PROY	PROP	SENC	SIM
87 01 12	R	BDL	BDL	BDL	BDL	BDL	NR	NR	BDL	BDL	BDL	BDL	BDL	BDL
87 01 12	T	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
87 02 09	R	BDL	BDL	BDL	BDL	BDL	NR	NR	BDL	BDL	BDL	BDL	BDL	BDL
87 02 09	T	BDL	BDL	BDL	BDL	BDL	NR	NR	BDL	BDL	BDL	BDL	BDL	BDL
87 03 09	R	BDL	BDL	BDL	BDL	BDL	NR	NR	BDL	BDL	BDL	BDL	BDL	BDL
87 03 09	T	BDL	BDL	BDL	BDL	BDL	NR	NR	BDL	BDL	BDL	BDL	BDL	BDL
87 03 18	R	BDL	BDL	BDL	BDL	BDL	NR	NR	BDL	BDL	BDL	BDL	BDL	BDL
87 03 18	T	BDL	BDL	BDL	BDL	BDL	NR	NR	BDL	BDL	BDL	BDL	BDL	BDL
87 04 06	R	BDL	BDL	BDL	BDL	BDL	NR	NR	BDL	BDL	BDL	BDL	BDL	BDL
87 04 06	T	BDL	BDL	BDL	BDL	BDL	NR	NR	BDL	BDL	BDL	BDL	BDL	BDL
87 05 11	R	BDL	BDL	BDL	BDL	BDL	NR	NR	BDL	BDL	BDL	BDL	BDL	BDL
87 05 11	T	BDL	BDL	BDL	BDL	BDL	NR	NR	BDL	BDL	BDL	BDL	BDL	BDL
87 06 08	R	BDL	BDL	BDL	BDL	BDL	NR	NR	BDL	BDL	BDL	BDL	BDL	BDL
87 06 08	T	BDL	BDL	BDL	BDL	BDL	NR	NR	BDL	BDL	BDL	BDL	BDL	BDL
87 07 13	R	BDL	BDL	BDL	BDL	BDL	NR	NR	BDL	BDL	BDL	BDL	BDL	BDL
87 07 13	T	BDL	BDL	BDL	BDL	BDL	NR	NR	BDL	BDL	BDL	BDL	BDL	BDL
87 08 10	R	BDL	BDL	BDL	BDL	BDL	NR	NR	BDL	BDL	BDL	BDL	BDL	BDL
87 08 10	T	BDL	BDL	BDL	BDL	BDL	NR	NR	BDL	BDL	BDL	BDL	BDL	BDL
87 09 14	R	BDL	BDL	BDL	BDL	BDL	NR	NR	BDL	BDL	BDL	BDL	BDL	BDL
87 09 14	T	BDL	BDL	BDL	BDL	BDL	NR	NR	BDL	BDL	BDL	BDL	BDL	BDL
87 10 13	R	BDL	BDL	BDL	BDL	BDL	NR	NR	BDL	BDL	BDL	BDL	BDL	BDL
87 10 13	T	BDL	BDL	BDL	BDL	BDL	NR	NR	BDL	BDL	BDL	BDL	BDL	BDL
87 10 27	R	BDL	BDL	BDL	BDL	BDL	NR	NR	BDL	BDL	BDL	BDL	BDL	BDL
87 10 27	T	BDL	BDL	BDL	BDL	BDL	NR	NR	BDL	BDL	BDL	BDL	BDL	BDL
87 11 10	R	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 11 10	T	BDL	BDL	BDL	BDL	BDL	NR	NR	BDL	BDL	BDL	BDL	BDL	BDL
87 12 07	R	BDL	BDL	BDL	BDL	BDL	NR	NR	BDL	BDL	BDL	BDL	BDL	BDL
87 12 07	T	BDL	BDL	BDL	BDL	BDL	NR	NR	BDL	BDL	BDL	BDL	BDL	BDL

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MET - Metolachlor
PROM - Prometone
PROY - Prometryne
PROP - Propazine
SENC - Sencor (Metribuzin)
SIM - Simazine

PESTICIDES IN ONTARIO SURFACE WATER SUPPLIES (1987): DWSP RESULTS REGION: WEST CENTRAL LOCATION: BRANTFORD

YR MO DY	TYPE	ALCH	AMET	ATRO	ATRA	CYAN	DATRA	DSIM	MET	PROM	PROY	PROP	SENC	SIM
87 01	R	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 01	T	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 02	R	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 02	T	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 03	R	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 03	T	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 04	R	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 04	T	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 05	R	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 05	T	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 06	R	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 06	T	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 07	R	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 07	T	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 08	R	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 08	T	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 09	R	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 09	T	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 10	R	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 10	T	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 11	R	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 11	T	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
87 12 14	R	BDL	BDL	BDL	0.30	<T	BDL	NR	NR	BDL	BDL	BDL	BDL	BDL
87 12 14	T	BDL	BDL	BDL	0.37	<T	BDL	NR	NR	BDL	BDL	BDL	BDL	BDL

NOTE: Units = ug/L Type R - Raw T - Treated BDL - Below Detection Limit NR - No Result <T - A measurable trace amount: tentative

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AMET - Ametryne
ATRO - Atratone
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CYAN - Cyanazine
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